Water Management Plan

United States Environmental Protection Agency
National Health and Environmental Effects Research Laboratory
Atlantic Ecology Division
27 Tarzwell Drive
Narragansett, Rhode Island 02882

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EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HEALTH AND ENVIRONMENTAL RESEARCH LABORATORY
ATLANTIC ECOLOGY DIVISION

WATER MANAGEMENT PLAN

Approved by:

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1.0 EPA'S STATEMENT OF PRINCIPLES ON EFFICIENT WATER USE

In order to meet the needs of existing and future populations and ensure that habitats and ecosystems are protected, the nation's water must be sustainable and renewable. Sound water resource management, which emphasizes careful, efficient use of water, is essential to achieve these objectives.

Efficient water use can have major environmental, public health, and economic benefits by helping to improve water quality, maintain aquatic ecosystems, and protect drinking water resources. As we face increasing risks to ecosystems and their biological integrity, the inextricable link between water quality and water quantity becomes more important. Water efficiency is one way of addressing water quality and quantity goals. The efficient use of water can prevent pollution by reducing wastewater flows, recycling process water, reclaiming wastewater, and using less energy.

EPA recognizes that regional, state, and local differences exist regarding water quality, quantity, and use. Differences in climate, geography, and local requirements influence the water-efficiency programs applicable to specific facilities. Therefore, EPA is establishing facility-specific Water Management Plans to promote the efficient use of water and meet the water conservation requirements under Executive Order 13123, Greening the Government Through Efficient Energy Management.

This Water Management Plan has been established to document and promote the efficient use of water at the National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division Facility in Narragansett, Rhode Island. The plan is organized according to the Federal Energy Management Program (FEMP) Facility Water Management Planning Guidelines under Executive Order 13123.

2.0 FACILITY DESCRIPTION

The Narragansett laboratory is a state-of-the-art aquatic research facility for EPA's National Health and Environmental Effects Research Laboratory (NHEERL), Atlantic Ecology Division (AED), under the Office of Research and Development (ORD). The mission of AED at Narragansett is to develop and evaluate theory, methods, and data to better understand and quantify the environmental effects of stressors on the coastal waters and watershed of the Atlantic Seaboard.

AED is located approximately 30 miles south of Providence, Rhode Island, on an 11-acre site overlooking the West Passage of Narragansett Bay. The surrounding area is predominantly rural or residential in character. Adjacent to AED is the 165-acre Narragansett Bay Campus housing the University of Rhode Island's Graduate School of Oceanography, the Coastal Institute, the Marine Resources Center, the Rhode Island Nuclear Science Center; and the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service's Narragansett Laboratory. AED's 13 buildings provide 69,182 square feet for research and research support activities.

The AED facility is owned and operated by EPA. The majority of the space (approximately 60,000 square feet) is contained in a main laboratory/office building complex that houses the reception area, administrative support and scientific staff office space, conference rooms, dry and wet-laboratory space, sea water tempering equipment, and space for the storage of scientific samples. Other structures include the support services building, containing various workshops, field operations spaces, and boat storage; a pier and associated pump house that provides sea water to the laboratory; and the hazardous materials building containing segregated waste and chemical supplies. Additional activities take place in various small external structures such as the pollutant abatement building, walk-in cold storage, and a greenhouse.

The Laboratory provides research support to EPA program offices and Regions in areas related to the protection of coastal marine ecosystems. Areas of research specialization include: understanding, quantifying, and modeling the cumulative effects of multiple anthropogenic stressors on coastal ecosystems; development of methods for assessing the ecological effects of contaminated marine sediments; development of species, population, and community-level indicators of ecological impacts resulting from anthropogenic activities; and place-based integrated ecological assessments for the Atlantic Coast.

The AED has two marine wet laboratory facilities. The original wet laboratory, which is the smaller of the two, contains two microcosm rooms, one marine algae culture chamber, 10 wet tables, and office space for scientific staff. The main wet laboratory, constructed in the mid 1970's, contains the following areas: a high hazard testing area, a low hazard testing/holding area, a marine algae/plant laboratory, a general purpose and glass fabrication shop, a sea water filtration system room, and an electronic control room. Sea water supplied to laboratory spaces can either be unfiltered (i.e., directly from Narragansett Bay), or it can be filtered before use. Both types of water can be temperature controlled by heating and cooling.

AED houses two microcosm facilities containing 10 and 20 separate chambers, each with the capability to support individual microcosms. Each microcosm is an independent 140 liter

containerized system composed of intact benthic and pelagic communities. Within each, pumps, paddles, and fluorescent lights model the effects of tide, current, and the solar cycle to directly assess the effects of various contaminants on model ecosystems.

AED also has nine laboratory rooms devoted to chemical, biological, and geological sample preparation and analyses. An information technology center, conference center, and library facilities are also contained within the main building.

3.0 FACILITY WATER MANAGEMENT GOALS

The water management goals of AED are achieved through the implementation of an Environmental Management System (EMS). The EMS is being established and implemented consistent with the laboratory environmental management policy. The AED environmental management policy statement is provided below.

Environmental Management Policy

The U.S. Environmental Protection Agency's Office of Research and Development (ORD) mission is to perform state-of-the-art research to identify, understand, and solve current and future environmental problems, provide responsive technical support to EPA's mission, integrate the work of ORD's scientific partners (other agencies, nations, private sector organizations, and academia), provide leadership in addressing emerging environmental issues, and advance the science and technology of risk assessment and risk management.

ORD continues to encourage and set an example of research and development activities which use effective EMSs that focus on regulatory compliance, pollution prevention, resource preservation, and public outreach. With this policy, NHEERL - AED joins other ORD sites in committing to implement EMS for our own employees, operations, and facilities. Collectively, ORD will become a leader in executing a model EMS within the Agency.

At AED, we commit to reduce the environmental impacts and consumption of natural resources from our facility operations and comply with all legal and applicable requirements. Our EMS will be designed to meet the following goals:

- Ensure compliance by meeting or exceeding all applicable environmental requirements while conducting research activities;
- Strive to continuously improve environmental performance;
- Integrate source reduction and other pollution prevention approaches into day-to-day research activities;
- Consider the environment when making all planning, purchasing, and operating decisions;
- Establish, track and review specific environmental performance goals and employee awareness; and
- Share performance information with our research partners and other interested parties.

4.0 UTILITY INFORMATION

Contact Information

Potable water supply is provided by:

United Water Rhode Island€
17 Arnold Street€
P.O. Box 429€
Wakefield, RI 02880-0429€

401-789-0271€

Sewer service is provided by:€

University of Rhode Island€
Facility Management Division€
Old Plains Road€
Kingston, RI 02881€

Attn: Dave Lamb€
401-874-7896€

Rate Schedule

Water supply is billed in two components:
1) A base water rate of $1.415 per 100 cubic feet
2) A drinking water protection fee of $0.218 per 100 cubic feet

The combined rate is $1.633 per 100 cubic feet€

In addition, there are quarterly fees as follows:€
$26.63 for each 1-inch water meter€
$53.58 for each 2-inch water meter€
$100 for fire protection service€

URI bills AED a flat annual fee of $3,800 for sewer service. This fee, provided at a discount to€ prevailing commercial rates, reflects URI's 46 percent ownership in the combined Narragansett/€ South Kingston Waste Water Treatment Plant.€

Payment Office

U.S. Environmental Protection Agency
Account Operations Office
26 West Martin Luther King Drive
Cincinnati, OH 45268

5.0 FACILITY INFORMATION

The predominant features of the AED Laboratory are the wet laboratory and microcosm facilities where research is conducted on aquatic species and systems. These facilities are supplied with either filtered or unfiltered sea water from Narragansett Bay. The laboratory is equipped to temper the incoming sea water by either heating or cooling to provide for a wide range of experimental conditions.

Sea water is obtained directly from the bay via a pump house mounted on a pier at approximately 400 gallons per minute (gpm). The flow is split at the main laboratory building, where 300 gpm are routed to the wet labs and microcosm facilities to support the laboratory science program. The remaining 100 gpm are routed to an adjacent research facility operated by the NOAA. After flowing though the various supply headers, wet labs, and microcosms, the sea water is collected and returned to the bay. This sea water is not the subject of this water management plan. Rather, the focus of this plan is potable water.

Potable water is obtained from the local water utility and used as process water in some of the laboratories (e.g., as source water for deionized water supply, glassware washing, sterilization), cooling tower make-up, boiler make-up, equipment cooling, and sanitary supply. The facility is not equipped with an irrigation system; therefore, virtually no water is used for landscape irrigation. The remainder of this plan discusses potable water use throughout the facility.

Major Water Using Processes

Estimates of potable water consumption by major use area are provided in Table 1. These data reflect average facility water use between January and December 2002.

Table 1
Major Water Using Processes

Major Process	Annual Consumption (gallons)	Percent of Total	Comments
Cooling tower make-up	1,700,000	49	Based on average daily meter readings
Once-through equipment cooling	970,000	28	Projected from instantaneous measurements
Sanitary	550,000	16	Engineering estimate
Laboratory process water use, boiler make-up, and other miscellaneous uses	220,800	7	Calculated as remaining difference from metered total
TOTAL	3,440,800	100	Metered

Because cooling tower water consumption occurs primary between April and October, water use varies seasonally. Additional detail on assumptions and calculations supporting these water use estimates are provided in Appendix A.

Measurement Devices

Incoming city water is supplied through four meters. A 4-inch water main enters the main laboratory building in the boiler room, immediately splits into two, 2-inch metered services that join again after metering to feed a common header. Separate metered water supply is also provided to the support services and the hazardous materials buildings. Total flow at each meter is recorded quarterly. Typically, no flow is registered on the meter installed at the hazardous materials building, as this metered supply is required only during unusual circumstances.

The make-up line to the cooling tower is equipped with a meter. Cooling tower water use is recorded daily by the facility operations and maintenance (O&M) contractor.

Shut-off Valves

City water shut-off valves are located at each main water supply meter location.

Occupancy and Operating Schedules

Approximately 140 employees work at the AED Laboratory year-round, with an additional 20 personnel on site during the summer season. The laboratory operates on a flex time schedule and is typically occupied between 5:30 a.m. and 7:00 p.m., Monday through Friday.

6.0 BEST MANAGEMENT PRACTICE SUMMARY AND STATUS

FEMP has identified Water Efficiency Improvement Best Management Practices (BMPs) in 10 possible areas. Implementation of BMPs in four or more areas are required under FEMP guidance. The AED Laboratory has adopted and will maintain BMPs in six of the 10 areas, as checked below:

- ✓ Public Information and Education Programs€
- ✓ Distribution System Audits, Leak Detection, and Repair€
- ✓ Water-Efficient Landscape€
- ❑ Toilets and Urinals€
- ✓ Faucets and Showerheads€
- ✓ Boiler/Steam Systems€
- ❑ Single-Pass Cooling Systems€
- ✓ Cooling Tower Systems€
- ❑ Miscellaneous High Water-Using Processes€
- ❑ Water Reuse and Recycling€

A description of the laboratory's approach under each of the 10 areas is described below.

Public Information and Education Programs (BMP #1)

As part of the effort undertaken to develop this water management plan, AED identified the need to provide addition information to staff on water conservation aspects of laboratory operations. To address this need, an informational poster was conceived and printed with support from the Sustainable Facilities Practices Branch. These conservation posters, "Every Drop Counts....Count Every Drop" provide information on how specific laboratory actions conserve water and are now displayed in prominent locations throughout the building. The poster also has been distributed to all other EPA laboratories to raise water conservation awareness throughout the Agency.

The on-site O&M contractor has been made aware that water and energy conservation are key operating principles for the laboratory. These practices are integrated into building system operation and maintenance practices wherever practical. Internal and external awareness of water conservation issues also is promoted through the activities associated with the Sustainable Site Master Plan, currently under development.

Distribution System Audits, Leak Detection, and Repair (BMP #2)

A screening level system review was conducted in April 2003 to develop this plan, and known water uses account for greater than 90 percent of water consumption.

Facility staff are trained to report leaks and malfunctioning water using equipment to a facility maintenance help line. Reported problems are assigned a work order, which is completed by the facility O&M contractor. Work orders are tracked in an electronic database though completion and close out. A plumber on the O&M contractor staff makes a daily walk-through inspection of all water-using processes. Any problems or leaks identified are addressed immediately.

Water-Efficient Landscape (BMP #3)

Much of the 11-acre AED compound is wooded and has been returned to a natural setting. No irrigation is used to maintain the grassy areas immediately surrounding the building; they are allowed to brown out during dry periods and are naturally restored when precipitation occurs.

AED is in the process of implementing a sustainable landscape plan with a goal of eliminating all mowable grass areas within the next five years. AED is examining the feasibility of installing a rainwater collection cistern as part of its Sustainable Site Master Plan, which could be used to drip irrigate landscaped plant beds and help eliminate mowable areas.

Toilets and Urinals

Table 2 located at the end of this plan provides an inventory of current sanitary fixtures. The fixtures installed in the new wing are low-flow (less than 1.6 gallons per flush for toilets and 1.0 gallons per flush for urinals). However, the majority of the remaining fixtures were installed prior to 1992 and have flush rates greater than that of low-flow fixtures. While the older style toilets in the administration area exceed current low-flow standards, they have been equipped with automatic flush valves. Toilets that exceed 1.6 gallons per flush and urinals that exceed 1.0 gallons per flush will be considered for upgrade under the laboratory renovations envisioned under the Laboratory Sustainable Master Plan.

Janitorial staff and employees are trained to report leaks or other maintenance problems to the facilities maintenance help line. Reported problems are assigned a work order, which is completed by the facility O&M contractor. Work orders are tracked in an electronic database though completion and close out.

BMP credit in this area is not claimed at this time, pending upgrade of sanitary fixtures to low-flow design under the Laboratory Sustainable Master Plan.

Faucets and Showerheads (BMP #4)

Table 2 located at the end of this plan provides an inventory of faucets and showerheads and their associated design flow rates. The faucets installed as part of the new wing addition are low-flow (under 2.2 gpm). Many additional faucets have been upgraded or equipped with low-flow aerators. For example, faucets in the administration area are ultra low-flow (0.5 gpm) and are equipped with automatic sensors to control flow. Low-flow faucets will be installed in the laboratory area during the laboratory upgrade envisioned under the Laboratory Sustainable Master Plan.

All showerheads have low-flow ratings, with flow rates of 2.5 gpm or less. System pressure is maintained at 60 pounds per square inch, within the range recommended for optimum system performance.

Janitorial staff and employees are trained to report leaks or other maintenance problems to the facilities maintenance help line. Reported problems are assigned a work order, which is

completed by the facility O&M contractor. Work orders are tracked in an electronic database though completion and close out.

Boiler/Steam Systems (BMP #5)

The laboratory is equipped with two steam boilers of approximately 10.4 million BTU/hour each that produce low-pressure steam. The steam is delivered to shell and tube heat exchangers to produce hot water that is circulated through preheat coils, reheat coils, perimeter radiation, and sea water processing heat exchangers. Steam is also used to produce domestic hot water in a steam heat exchanger. Steam condensate is captured and returned to the boilers. A small quantity of steam is blown down from the boilers each morning as a preventive maintenance measure. Chemical treatment is provided by a water treatment contractor to prevent scale formation and corrosion.

A Building and Facilities (B&F) budget request to upgrade the boiler system has been submitted for FY 06 and 07. In addition, a solar hot water heating system will be evaluated as part of the Laboratories Sustainable Master Plan.

Single Pass-Cooling Equipment

Continuous single-pass cooling has been used to cool compressed air exiting the ring compressor to temper the air prior to supplying it to the wet laboratory. AED is currently evaluating ways to eliminate, reduce, or reuse this flow.

Continuous single-pass cooling was used in the past to temper a reservoir of water used to cool a vacuum pump on one of the experimental set-ups. While this flow is reflected in the water balance presented in Section 5.0, this system has subsequently been secured and the continuous flow eliminated. Use of this cooling water supply will be monitored and reevaluated when this system is used in the future.

BMP credit in this area is not claimed at this time, pending elimination of single-pass cooling on the ring compressor.

Cooling Tower Systems (BMP #6)

A new cooling tower system was installed in 2001. Cooling tower system performance is monitored and maintained regularly by the building O&M contractor. The cooling tower make-up water flow rate is metered and recorded daily by the O&M contractor. A conductivity meter is used to automatically control cooling tower blow down; the conductivity meter is regularly maintained by the O&M contractor. The conductivity target for the system is 900 to 1,100 *u*S/cm. This conductivity control point provides for approximately five to six cycles of concentration and efficient cooling tower water use.

Chemical treatment is provided by a cooling tower maintenance contractor to control scale and corrosion. The contractor routinely monitors the cooling system water quality for optimum performance and is informed that water conservation is an operational goal of the facility.

Miscellaneous High-Water Using Processes

Deionized water is generated though cartridge resin beds. Deionized water is blended with sea water to reduce the salinity of water supplied to the wet laboratory areas where estuary research is conducted. No BMP credit is claimed in this area at this time.

Water Reuse and Recycling

AED will explore the feasibility of capturing storm water collected from roof drains in a cistern for reuse. Potential reuse options include using the storm water for drip irrigation of landscaping, as cooling tower makeup water, or for flushing toilets. These options are being evaluated as part of the development of an overall Sustainable Site Master Plan. No BMP credit is claimed in this area at this time, pending implementation of a storm water reuse option under the Sustainable Site Master Plan.

7.0 DROUGHT CONTINGENCY PLAN

AED will follow the water use recommendations and restrictions of United Water of Rhode Island, which typically establishes its drought response actions in coordination with the towns of Narragansett and Kingston. The overall drought management approach in Rhode Island is coordinated under the Rhode Island Drought Management Plan, which is found at:

http://www.planning.ri.gov/landuse/dmp.htm

As a matter of general operating practice, AED already follows most of the water conservation approaches that are recommended or could be required under drought conditions. Water is not used for decorative fountains, maintenance of paved surfaces, or landscape irrigation, and motor vehicles are washed at commercial car washes.

When voluntary or mandatory water use restrictions are instituted by United Water, the requirements are communicated to the Facilities Manager. The Facilities Manager assembles a task force of facility and operating personnel to identify and implement modifications to facility operations to achieve additional specified reductions in water consumption.

8.0 COMPREHENSIVE PLANNING

Consistent with the AED environmental management policy to consider the environment when making all planning, purchasing, and operating decisions, the Facilities Manager will ensure that water supply, wastewater generation, and water efficiency BMPs are taken into account during the initial stages of planning and design for any facility renovations or new construction. These factors will also be considered prior to the purchase and installation of any equipment that would measurably change facility water consumption.

9.0 OPPORTUNITIES FOR FURTHER WATER CONSERVATION

AED is considering several projects to achieve additional reductions in water use, listed below:

1) Rainwater Harvesting. As part of the development of its Sustainable Site Master Plan, AED is evaluating the feasibility of collecting storm water from roof drains in a cistern. Potential storm water reuse for landscape drip irrigation, cooling tower make-up water, and toilet flushing will be examined.

2) Sanitary Fixture Upgrades. As part of the implementation of its Laboratory Modernization, AED will consider upgrade to the sanitary fixtures in the main laboratory/office building complex to low flow design. Up to 12 toilets and 7 urinals could be upgraded, depending on the number of restroom facilities selected for upgrade. At an installed cost of $500 per fixture, simple payback on each fixture upgraded is 15 years, at current water rates. If urinals are upgraded, a waterless design will be considered. Waterless urinals can be installed for approximately the same cost as flush units, and eliminate the use of flush water. Lavatory faucets in the laboratory area also will be equipped with low-flow aerators.

3) Air Compressor Once Through Cooling. AED is evaluating the elimination of once-through water used to cool compressed air exiting the ring compressor. The feasibility of using a point-of-use chiller for the cooling water flow, or another heat sink such as sea water or recirculated chilled water, will be examined.

Table 2
Inventory of Sanitary Fixtures
AED Laboratory, Narragansett, Rhode Island

Building	Sub-Location	Fixture	Quantity	Flow Rating
Support Services	**T103**	Toilet	1	Briggs 1.5 (<1.6 GPF)
		Sink	1	2 GPM
	T101	Toilet	1	Kohler (>1.6 GPF)
		Sink	1	3 GPM
	Dive Locker	Toilet	1	Kohler (>1.6 GPF)
		Sink	1	3 GPM
		Shower	2	Water Saver (<2.5 GPM)
Field Operations	**Bathroom**	Toilet	1	Briggs 1.5 (<1.6 GPF)
		Sink	1	1 GPM
New Wing 1st Floor	**Men's**	Toilet	1	American Standard 1.6 GPF
		Urinal	1	American Standard 1.0 GPF
		Sink	1	2 GPM
	Women's	Toilet	2	American Standard 1.6 GPF
		Sink	1	2 GPM
New Wing 2nd Floor	**Men's**	Toilet	1	American Standard 1.6 GPF
		Urinal	1	American Standard 1.0 GPF
		Sink	1	2 GPM
	Women's	Toilet	2	American Standard 1.6 GPF
		Sink	1	2 GPM
Admin 1st Floor	**Men's**	Toilet	1	Eljer (>1.6 GPF, automatic flush sensor)
		Urinal	2	Eljer (>1.0 GPF, automatic flush sensor)
		Sink	2	0.5 GPM
		Shower	1	Water Saver (<2.5 GPM)
	Women's	Toilet	1	Eljer (>1.6 GPF, automatic flush sensor)
		Sink	2	0.5 GPM
		Shower	1	Water Saver (<2.5 GPM)
Admin 2nd Floor	**Men's**	Toilet	2	Eljer (>1.6 GPF, automatic flush sensor)
		Urinal	2	Eljer (>1.0 GPF, automatic flush sensor)
		Sink	2	0.5 GPM
	Women's	Toilet	2	Eljer (>1.6 GPF, automatic flush sensor)
		Sink	2	0.5 GPM
Laboratory	**Men's**	Toilet	2	Kohler (>1.6 GPF)
		Urinal	2	Kohler (>1.0 GPF)
		Sink	2	3 GPM
	Women's	Toilet	2	Kohler (>1.6 GPF)
		Sink	2	2 GPM

Building	Sub-Location	Fixture	Quantity	Flow Rating
Mezzanine	**Men's**	Toilet	1	Kohler (>1.6 GPF)
		Urinal	1	Kohler (>1.0 GPF)
		Sink	1	3 GPM
	Women's	Toilet	1	Kohler (>1.6 GPF)
		Sink	1	3 GPM
Pollution Abatement	**T101**	Toilet	1	American Standard (>1.6 GPF)
		Sink	1	1 GPM
		Shower	1	2 GPM
		Total	60	

APPENDIX A
WATER BALANCE SUPPORTING CALCULATIONS

AED Laboratory, Narragansett, Rhode Island

Major Process	Annual Consumption (gallons)	Supporting Calculations
Cooling tower make-up	1,700,000	Based on average daily cooling tower make-up of 8,000 gallons per day, and a cooling season that runs from April 1 to Nov. 1. 8,000 gallons/day *214 days = 1,712,000 gallons.
Once-through equipment cooling	970,000	Based on 0.75 gpm continuous flow on ring compressor and 1.1 gpm continuous flow on DO tempering unit. 1.85 gpm * 60 minutes/hr * 24 hr/day * 365 days/year = 972,360 gallons.
Laboratory process water use, boiler make-up, and other miscellaneous uses	220,800	By difference: 3,440,800 - 1,700,000 - 970,000 - 550,000 = 220,800 gallons.
Sanitary	550,000	Based on 15 gallons per person per day. Assume 140 people year round at 250 operating days, and 20 additional people in summer months at 80 operating days. (140 people * 15 gallons/person-day *250 days) + (20 people * 15 gallons/person-day *80 days) = 549,000 gallons.
TOTAL	3,440,800	From monthly meter readings